

Standard Chemical Ignition Source Characteristics for Flammability Testing

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Problem: Validation data were needed for igniter performance



Composition of Chemical Igniters Used in Material Flammability Testing

70.2% Hexamethylenetetramine ($(CH_2)_6N_4$)
26.3% Anhydrous Sodium Metasilicate ($(Na)_2SiO_3$)
3.5% Arabic Gum - Acacia Gum (Carbohydrate Polymer); Water Soluble

Performance Specifications

Flame Temperature: $1100 \pm 90^\circ\text{C}$ ($2000 \pm 160^\circ\text{F}$)
Igniter Burn Time: 25 ± 5 s
Peak Flame Height: 4.4 ± 0.94 cm (2.5 ± 0.25 in)

Chemical Igniter

Test Results



Figure 1. Equilibrium Chemical Igniter Weight Ratios as a Function of Humidity Level

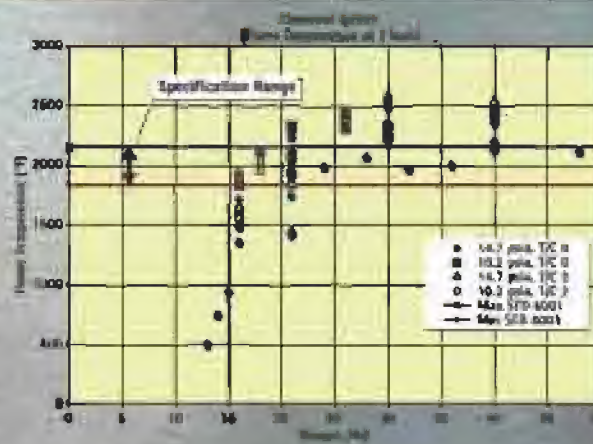


Figure 2. Igniter Flame Temperature at 1 inch

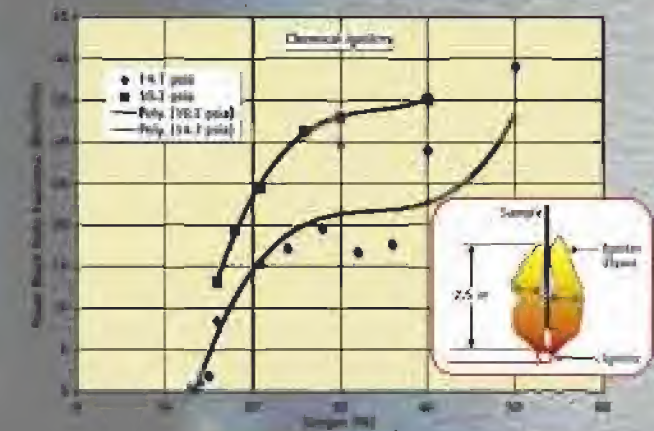


Figure 3. Flame Black Body Radiation

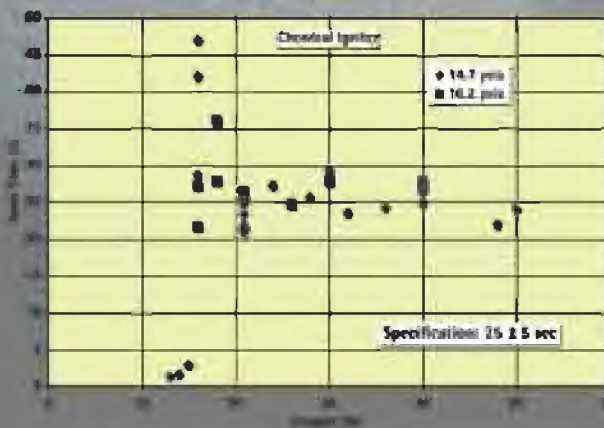


Figure 4. Igniter Burn Time as a Function of Oxygen Level

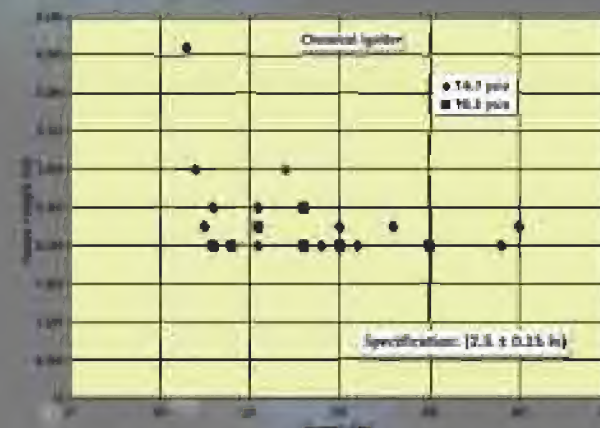


Figure 5. Maximum Flame Height

Conclusions:

- Chemical igniter weights: determined to be within the STD 6001 range; form normal distribution across range; average weight = 0.2168 g
- Humidity effects: minimal when humidity $< 40\%$; potentially very significant effects when $> 40\%$
- Igniter flame temperatures: drop $< 1840^\circ\text{F}$ at $< 18\%$ O_2 conditions; measured $> 2160^\circ\text{F}$ for 10.2 psia and $> 20\%$ O_2
- Potential radiation heating from igniter flame to sample changed from 16 to 35 Btu/ft²/s when changing from 20% to 50% O_2 at 14.7 psia. Temperature implied radiative heating was always higher for lower pressure (10.2 psia) than for higher pressure (14.7 psia) at the same O_2 level
- Flame height: outside specifications 60% of the time
- Burn time correlated by burn weight: within specifications for $> 20\%$ O_2 concentrations
- Demonstrated capability of LabVIEW™ data acquisition system to capture transient data for new MAPTIS system



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